WRITTEN IN THE 17TH CENTURY BY A
FATHER OF THE SOCIETY OF JESUS

ARTE PALMÁRICA

TRANSLATED INTO ENGLISH FOR
THE FIRST TIME BY D.A. SMITH

ARTE PALMARICA

Written by a Father
of the
Society of Jesus

New Edition. Nova Goa – Imprensa Nacional – 1918

Translated into English for Goa,1556 by D.A. Smith

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Dedicated to those who created
knowledge relevant to Goa, in
centuries past and present.

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Translator's Note

The *Arte Palmárica* is a brief treatise on the cultivation of coconut palms, written by an anonymous Jesuit in Goa. The coconut has been a staple, and symbol, of Goa for centuries, and in this text the nameless author lays out a number of methods for producing the largest, healthiest yields possible. These methods, as he constantly reminds us, are based not on tradition, but on observation and experimentation, and hence superior to those employed by local growers. The author's disdain for these less scientific methods and those who use them is palpable throughout the text.

In their book *Catholic Orientalism: Portuguese Empire, Indian Knowledge, 16th-18th Centuries,* Ángela Barreto Xavier and Ines G. Županov describe the *Arte Palmárica* as "a remarkable document of that particular moment in the late seventeenth century when the Jesuits espoused ‘scientific’ methods in farming” (Xavier and Županov, 104-5). Father Charles Borges, S.J., also believes the text dates to the 17th century. While extant versions of the text date from no earlier than the mid-19th century, it makes sense that the *Arte Palmárica* is the product of a much earlier era, not least because the Jesuits were absent from Goa between 1759 and 1838. Furthermore, the author’s comment on the damage done to palm groves under his care by “the entrance of the Maratha enemy” is presumably a reference to the 1683 invasion of Goa by the Marathas, which would cement the *Arte Palmárica*, or at least its author, as belonging to the 17th century.

The Portuguese agronomist Eduardo Alberto Lima Basto, in his 1904 book *O Coqueiro na India Portuguesa*, mentions that the *Arte Palmárica* was written “ha mais de um seculo” (Lima Basto, 14), which strengthens arguments in favor of the text’s venerable reputation without, alas, adding any specificity. The fact that the treatise does not read—to me at least—like it was written in the 1600s is most likely due to “the ongoing Jesuit custom of ‘improving’ and ‘updating’ (or expurgating) their texts” (Xavier and Županov, 104-5). However, Monsenhor Sebastião Rodolfo Dalgado, in his indispensable Glossário Luso-Asiático, which cites the Arte Palmárica several times, refers to it as a product of the 18th century, thus leaving open the question of exactly when it was written.

This translationof the *Arte Palmárica* is based on the text of the 1918 edition (the “nova edição”) published by the Imprensa Nacional in Nova Goa, or Panjim. I also had access to the version included in the *Annaes do Conselho Ultramarino,* Parte Não Oficial, Serie 1, Fevereiro de 1854 a Dezembro de 1858, which was published in 1867 by the Imprensa Nacional in Lisbon. This latter version was useful in clarifying certain grammatical and typographical questions, and is noteworthy in itself because the editor of the 1918 edition mentions neither it nor a previous printing in 1855 in the *Boletim e Annaes do Conselho Ultramarino* in his list of previous editions of the *Arte Palmárica.*

Rather than render every agricultural term used by the anonymous Jesuit author into English, I have left many of them in Portuguese or Konkani, both to give the reader a sense of how the author incorporated local vocabulary into his coconut-growing lexicon, and to maintain the original tone of the work. This latter reason is also why the title remains untranslated. I have included explanatory footnotes as necessary, of course.

I’d like to thank Frederick Noronha for bringing this short but quite interesting monograph to my attention in the first place. Egídio Moniz provided helpful explanations of certain agricultural vocabulary, and Father Charles Borges, S.J., contextualized the treatise in relation to the Society of

Jesus. The fine souls who make up the Pensando Goa group have always made their vast expertise available. Daniel Michon graciously took the time to read my English translation, and my wife Tracey provided constant support simply by being herself. *Obrigado a todos,* and as always, any errors are entirely mine.

D.A. Smith
Houston, Texas
March 2022

ARTE PALMÁRICA — a special treatise on the cultivation of palm groves— written by one of the fathers of the Society of Jesus, was published for the first time by the National Press of this city in 1841 by the General Secretary of the Government, Cláudio Lagrange — quarto of 18 pages — and later inserted by Filipe Neri Xavier in 1852 into his *Bosquejo Histórico das Comunidades* [Historical Outline of the Comunidades].

Bernardo Francisco da Costa transcribed the *Arte Palmárica* from the *Bosquejo* into his *Agricultor Indiano* [Indian Agriculturalist], vol. 1, p. 141-168, published in Lisbon in the year 1872, correcting some words that must have been typographical or copying errors, and interspersing within the text, in italics to distinguish them from the author's own words, several parentheticals explaining Indian phrases and measures.

J.I. De Loiola followed the improved text in his booklet *Culturas Indianas* [Indian Cultures], printed in 1896.

As the edition of 1841 is entirely out of print, and the *Bosquejo Histórico das Comunidades,* Bernardo Francisco da Costa's opus, and José Inácio de Loiola's booklet, are also rare in the country, this edition is being released now in accordance with the text used in the *Agricultor Indiano*, thereby popularizing a work in which there are many ideas of recognized benefit for local agriculture.

Preliminary Note

ARTE PALMARICA

WRITTEN BY A FATHER OF THE SOCIETY OF JESUS

1. Just as in other parts of the world there is a variety of plantations from which landlords make their living, there are also plantations here in Asia, very different from those of Europe, Africa, and America. The principal ones, being more common and profitable because they are more fruitful, are palm groves, whose trees (unlike any others) bear fruit twelve times a year, like the tree Saint John saw in his Apocalypse, because each month they produce a bunch of coconuts, larger or smaller according to the treatment given to them by the palm-grower and the quality of the soil in which they are planted. And there are

palms that give fifteen or sixteen bunches a year, from one of which I saw 196 coconuts obtained from a single harvest, all of them good and well-formed. There are bunches of great number, as was seen on a Gudêm plantation, where one was found that had 300-odd coconuts.

2. Furthermore, of all trees, the palm is the most helpful and of greatest utility, because from it comes wine, oil, vinegar, sweets, water, and sustenance. Its fruit has traveled everywhere, and is held in great esteem and highly valued; it is used in sacrifices the *gentios* [i.e., Hindus] make to their idols, and in large parties and weddings, especially after being dried.

Here in India it is generally put into the seasonings of various stews, used for coconut milk, or simply shredded. Houses are covered with its wood and leaves, which are called *olas*; buoys for boats are made from the wood, and many other things, which for brevity's sake I will not mention.

But to sum up: with what comes from the palm tree, one can put a sailboat out to sea with everything it needs, including the hull, masts, yards, ropes, cables, water, wine, oil, vinegar, provisions, and sweets. And for all these reasons it can be said in all truth, and without exaggeration, that the palm tree surpasses all other trees.

3. A good number of palm groves in Goa, Salcete, and Bardez send the greater part of their harvested fruit to the north and interior hinterlands, and if there were not this sort of plantation in the said provinces, it is without a doubt that their inhabitants would be extremely poor and would not have what they need to sustain themselves, because the plantations' revenues sustain not only the rich, but the poor with what they earn from farming; and I do not doubt that the palm groves would be even more profitable if every plantation owner would till and plant how and when they should.

4. However, some out of ignorance, and others out of poverty, do not do what they should, and ruin plantations similar to those that have demonstrated the experiences and observations made so many times. Therefore many of these plantations do not thrive, and the greater part of them are in ruins at the present time; and if not given aid, will totally cease to be; and due to over-specialization those planted in tainted soil have a disease called *Manddoly*[1], the nature of which is still unknown, because some say that it proceeds from overly cool or overly hot soil. The latter seems the most likely and almost certain, because a similar disease did not set in until there were

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[1] The *Glossário Luso-Asiático* describes *manddoly* (*mondolim* in Portuguese, from Konkani *mandalī*), when the term is used in relation to coconut palms, as an "fsendemic and deadly disease attributed to an overabundance of subsoil". The author uses three different spellings throughout the text, all of which I have left intact.

earthquakes in areas close to the sea, during which the earth exhaled great, warm vapors, which were even seen to come from the very sea; and therefore where this illness is found, the very color of the earth is scorched, as if it had been burned by a great fire.

5. What I suggest, so that all may have fine plantations of this sort, is that I teach them this art of how to plant, nurture, and proceed from that time forward in their farming. And if the rules which I have pointed out here are observed, I have no doubts that their plantations will be very fruitful and lucrative, and in short time will bear fruit, and remain productive and famously good, as experience has shown in plantations planted and farmed by these rules, and they will amaze and inspire admiration in all who see them. Some have approached and asked me what I have done to make my palm and jackfruit trees so successful, when theirs, repeatedly cultivated for years on end, barely provide a few weak yields, or are near death, or in many years never bear fruit. Those who asked me this were persuaded by my having a specific book by which I was guided and regulated. But what is certain is that I do not follow the customs observed by the natives on this subject; I was, and am, governed by my discernment, observations, and experiences founded upon sound reason.

Chapter 1: The Way to Choose Seed Coconuts

CHAPTER I: The way to choose seed coconuts

6. For seed coconuts to be good or not goes beyond palm groves being good or not. Some persuade themselves that seed coconuts need only be taken from this or that palm tree, as if the goodness of the seed depended on the quality of the soil. From here we see that some look for coconuts on the island of Juari, others in the village of Carmoná, as those grown in these parts tend to be larger than those grown in palm groves elsewhere.

But it is true that while I did not make my own observations, I sought seeds from those places to make the necessary plantings on the estates in my care; it went so badly that in the end I lost hope and gave up looking for seeds from elsewhere, and took them from the palm groves under my administration. By differing from everything that other palm-growers did, all went well. Even today some who have not communicated with me are working on this matter.

7. What others regularly do, when they want to pick seed coconuts, is to choose, during the February and May harvests, dry coconuts from the piles in which they are collected, and keep them as seeds, but in doing so they make two mistakes. The first is that one cannot tell which tree coconuts taken from the pile came from; if they came from old palms, young palms, or mature palms; from feeble palms, or from strong palms with good crowns; or if they have good or bad shells, because not all coconuts shells are good for seeds.

The second mistake they make is that, even if a palm tree's abundance and the quality of its coconuts is known, as they are pulled down they may fall to the ground from a great height with a mighty blow and break, or be shaken up; if they are broken, they rot and do not grow; if shaken, the young palms grow weakly, and they remain enfeebled no matter what. As such they either do not bear fruit or bear very little, and bad at that, even if the palm-grower takes good care of them,

8. Thus, for seed coconuts to be chosen accurately before the beginning of said harvests, which are the only ones from which seed coconuts should be taken, because those of August are very weak and of little substance, those who have palm groves must visit them and tiea frond to each tree from which seed coconuts are taken. These palms should not be less than thirty years old, and beyond that they should be strong and have a good crown and good bunches of coconuts.

Among these palms there is one that produces coconuts with red shells, and others that produce very green shells, and are always loaded with coconuts since the coconuts are not the largest, but for those who sell them in bulk, these are of the greatest usefulness. As long as there are these trees, do not take coconuts from the others.

But if you do take coconuts from other palms, beyond the aforementioned conditions of age and strength of crown, they hould not have stiff, upright fronds, but short, wide ones.

9. Once the palm trees are marked as discussed above, do not harvest coconuts from them, but set them apart them to be harvested in a month, or a month and a half, as the second and third bunches of coconuts are not yet perfectly ripe, and if collected too soon will not produce good trees. Therefore they should be given sufficient time to ripen

well; at most, coconuts from the first bunch can be collected in the manner I have described here.

10. So that the said bunches may have the time they need to mature, they should not be knocked down from the tree, but instead people should be sent up the tree, removing coconuts one by one and putting them in a basket, carried with them and tied to a rope as long as the tree is tall, which is tossed down without damaging the coconuts. And if not all these coconuts are good, one should only choose those with large pores and plump outer shells, and in no way shrunken or wrinkled, because these are signs that the coconuts within are not well-formed, and therefore will not do for seeds.

11. Having been picked and chosen according to the above method, put them somewhere sunny, with the pores upward, and dry until at least two-thirds of the water inside is gone. Then *digalengas*[2] of sufficient depth and plant the coconuts within them so that the soil remains only a finger or two above the pores, because with watering, which should be done daily, or at least every other day, the soil will be reduced so that the pores of the coconuts appear. At the bottom of the alengasthrow salt

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[2] The *Glossário Luso-Asiático* describes an *alenga* as “a pit surrounding a tree, or a large hole for planting small coconut palms. It is a term much used in Goa, and derived from Konkani *ālem*.” It also cites this very passage from the *Arte Palmárica* as an example of usage — something that occurs more than once.

mixed with ash in sufficient quantity, so that the *cariá*[3] does not rot the shells and damage the coconuts, which undoubtedly will not sprout; and do the same on top of the coconuts, primarily above the pores, before covering them with soil. After the coconuts have sprouted, even if only barely, remove them from the alengas, which should be refilled with salt and ash, and do as was done from the first time they were sown.

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[3] The *cariá*, per the *Glossário Luso-Asiático*, is a "white ant," or termite. "The damage caused by the termite [...] is well known."

2. On the Time and Method of Planting Young Plants

CHAPTER II: On the time and method of planting young palms after they have sprouted

12. When coconuts are chosen and sown according to the method referred to here, they will easily grow within four or five months, given good soil and regular watering. On the contrary, when coconuts are not chosen in this manner and covered with too much soil, as I have seen in coconuts sown by others, they will not sprout even in eight or nine months, because not only were they not chosen

well, they were buried below almost a *palmo*[4] of soil. And once they have grown enough that their combo (first bud) or pore reaches the height of a *palmo* or less, then transplant them if the time is right, as I will soon explain.

13. This method is not used by those who commonly do this sort of planting, because they wait until the young palms are a year old, or older, and then transplant them at the end of May, or the end of August, under the *mogó* star[5], but at neither time should planting be done, nor with such old palm trees. The reason for all of this is that, being transplanted so late, when they are uprooted the roots are broken and it is necessary to cut those that are not, which is very regrettable in young, tender plants. And if planted without roots in wintertime, when the earth is still cold and waterlogged, they die or become blighted, as I have seen and experienced many times. And if they are planted at the end of May, or shortly after at the beginning of June, and the winter weather finds them without roots, they will have the same lack of success.

14. Thus, the best time to transplant the young palms is

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[4] A *palmo* is equivalent to 22 centimeters or eight inches.

[5] The 1858 *Annaes do Conselho Ultramarino* explains the *mogó* star thusly: “The Indian calendar uses lunar months, which are divided into certain periods of seven and fifteen days, which are generally given the name of stars, and specifically the names of stars or constellations according to their mythology. The *Mogó* star falls more or less on 10 August and lasts until 24 August. The rains that fall during this period have an extraordinarily benign influence on all of the products of nature, and for the health of men.”

from November onward, in conjunction with the new moon, because when transplanted while still small, as I have said, they do not have roots outside their shells, or if they do they are so small they do not need to be cut or uprooted, and soon begin to put out roots in the soil into which they are transplanted, as they would in the ground itself. And at this time, if possible, it is good to dig deep holes into which the young palms can be transplanted without danger of their rotting, because they receive water only by direct watering, which is easily done and leaves the earth wet and fresh, and there is no place for the young palms to suffer the aforementioned harm they might suffer in winter; the reason being that those who plant in winter transplant the trees shallowly, and if they do not then add a good amount of fill soil, the palm trees are always weak, and topple easily in a strong wind.

15. I have always transplanted trees according to the above method and time, after having seen many times that palms transplanted according to the methods of others have not done well; however, after departing from the common method, I have always done well, with all the young palms growing strong, and none dying on me of *cariá* or other disease; and finally, having transplanted almost seven hundred palm trees this summer, only five died of the aforementioned causes, and the rest grew so healthy and perfect that they were admired by all.

16. After the young palms are thus planted, everyone is accustomed to build earthen berms around them, in which they plant *leiteiras*[6]. Asking about this on one occasion, the *mucadões* (tenant farmers)[7] replied that the berms keep the trees cool and defend them from cattle; but I pointed out to them that they were obviously deluded, because in the first place, if in the winter these berms fill with water, the young palms will be drowned and die, because their roots will rot; and in summer, far from cooling the palms, the berms will bake them, because not only do they express the direct heat of the sun, but the reflection given off by their edges is reflected toward the young palms. To make this more evident to the tenant farmers I had them break the edge of a berm, and it was clearly seen that all the soil was burned, as if it had been set on fire.

17. In addition, as the *leiteiras* themselves are very hot, and their shade very harmful, one thing or another would be sufficient to kill the young palms, and therefore all that

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[6] The *leiteira* is most likely *Euphorbia heterophylla*, also known as wild poinsettia (among other things). In correspondence with the translator, agricultural engineer Egídio Moniz notes that *leiteiras* were "planted in those days to supposedly bring benefits to the main crop planted. Which the author proves they were more of a disadvantage in this particular case."

[7] The author's parenthetical description of the *mocadão* (as it is spelled in the *Glossário Luso-Asiático*; the author uses both interchangeably) leaves out a meaning that Dalgado says is "now more widespread in Goa", namely "administrator of palm groves". The author uses the word this way in chapter IX.

are enclosed in this manner remain weak, yellow, and consumptive. Furthermore, the *leiteiras* stifle and block the wind needed by the young palms, and ultimately take for themselves all the strength, or coolness of the soil, that the young palms provide. And in regard to the berms defending the palms from being eaten by cattle, this is also a patently false thing, because any cow can eat them without impediment, as I showed the *mucadões*, and as any palm-grower can clearly see.

18. What I am accustomed to doing, and others do in imitation of me, is to plant the young palms in a shallow field without earthen berms, and surround them with bamboo stakes, or thorns, or something equivalent, which will defend them from cattle and not impeded the entrance and exit of the wind, and in this manner they will do well; and in time, as these fences are dismantled with great ease, one can plow or dig, none of which can be done if the young palms are enclosed according to the first method. I am well aware that this method requires greater expenditure; but I also know that it better to spend than for the young palms to die, be eaten by cattle, or be consumptive, and because of these reasons to plant fruitlessly and without gain. He who resolves to plant trees such as these should not save on expenses in order to succeed, because he will also recoup them faster with the fruit that the young palms will soon bear.

3. On The Method of Watering Young Plants

CHAPTER III: On the method of watering these young palms

19. Whether or not young palms grow well depends on whether or not they well-watered while they are very small, because, like children who are not given the necessary portion of good milk when they are young and grow up weak and ill, and never gain their strength however much they eat or drink, the same goes for young palms that from the start are watered well: they grow strong, and form good roots, and afterward bear good fruit. The method I observe in my plantings is the following. On the first day upon which I transplant them, I have poured onto each

palm three *calões*[8] of water at different times; on the second day two *calões*; on each of the following thirty days a *calão* (of about an *almude*[9]); and after the first thirty days, a *calão* of water every other day, and continuing in this way until the arrival of winter.

20. To some it will seem a great expense to water these young palms from November or December until June, and to avoid it they will plant in the winter; but they are not right to spare themselves this expense. First, if they follow the method used by everyone, they will have to water for three years, upon pain of the palms not growing well, or dying; the sooner they begin watering, the sooner they will be done, without creating more expense, because there is no difference whether one starts sooner and finishes sooner, or starts later and finishes later. Second, because it is given and not conceded, that if more money was spent, this greater expense would be well-spent and the palms successful and not lost to due a lack of watering, which would make it necessary to repeat, time and again, more expensive plantings without any of the young palms thriving, and with the loss of fruit, which would have been given earlier had the palms been competently watered.

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[8] The *Glossário Luso-Asiático* describes a *calão* (pl. *calões*) a jug or pitcher made of clay or copper that takes its name from the Tamil-Malayalam *kalam*.

[9] The *almude* is a liquid measurement, the volume of which has changed over time and still varies from place to place; it is currently equivalent to 25 liters.

21. During the watering of these young palms, ash and salt should also be put into the bottom of the holes into which the palms are transplanted, and into the pores of the same young palms to preserve them from *cariá* eating or gnawing them; after covering the hole some ash that is not mixed with salt should put in the *alenga*; and this should be continued every two months for the young palms to remain strong and well-formed, and free of cariá, because experience has shown that, if things are done this way, within a year the young palms will be so beautiful as to appear to be three to four years old.

4. Soil, Distance and Arranging Beds

Chapter IV: On the disposition of the soil in which one has to plant — distance that palms must have between themselves — method by which beds should be arranged and when

22. Many, if not all, of those who plant young palms do nothing more than dig pits in the earth and place the palms in them, even though the ground is uneven or steep, and wait until the palms are large to level it; but this is

incorrect, because before planting the young palms, the ground should be leveled, which later perhaps cannot be done without great expense, or great damage to the palms. And if, to avoid one thing or another, the ground is left uneven, the palms will never thrive, because all the winter rains will miss them, and the palms, being without coolness or moisture at their bases, will also be without fruit. I am well aware that there is some ground incapable of being flattened and made level; but in such a case boards, some taller than others, should be put in place to allow the winter rains to equally reach each young palm; and when this can not be fully done, then at the very least beds should be built up, one around each palm, but straight and equal, in such a form that they can at least be plowed.

23. These beds, and any others set up in the palm groves, should not be very large, but enough to contain six, eight, or nine palm trees, which, being small, will grow easily and with little expense, and when one wants to shallowly fill in the beds with soil, this service is done with less expense. I warn, however, that when these plantings are new, the soil must be level, and beds not set up unless the palms are three years old and no longer require watering. The reason for this is that if the beds are set up right away, when winter comes the beds will fill with water. However, three years must pass, and then the palms will have sufficient roots, and the more water the beds receive, the more the

young palms will thrive and swell.

24. As to distance, the natives absolutely say that there must be a distance of the length of a bamboo, that is, nine *mãos*[10] square (eighteen *palmos* on each side, or three hundred and twenty-four *palmos quadrados*), and their reason is because not being at the said distance the palms will be too densely packed, and some will obstruct the breeze from others, and without wind they will not bear the fruit that is due, as experience shows. I, however, say that rule should not be so invariable that it would be a mistake to do otherwise, which is why I think that the quality of the soil in which plantings are made must be attended to: if the soil is strong and verdant, the rule should be followed, and even greater distance given; if it is weak, less distance will suffice, and the weaker it is, the less distance will suffice; because in such soil the young palms do not grow large crowns and thus do not block the wind from others, and this puts and end to the reason for requiring, in strong and succulent soil, a distance of nine or ten *mãos*.

25. When, however, planting is done in furrows, which hold one or two rows of palms, then less distance will suffice, e.g., five or six *mãos*, maybe less. The reason for

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[10] Dalgado describes a *mão* ("hand" in Portuguese, a translation from Konkani *hāt*) as a measurement that is "generally [...] understood in Goa as half a *vara* or two *palmos*", so 44 centimeters. Our unnamed Jesuit also explains after the fact that one *mão* equals two *palmos*.

this is clear, and if planting is done in similar trenches, as the palms planted in them grow, their crowns will grow away from each other in order to catch the wind they need, because there are no trees beside them to impede this separation. However, plantations in which there are many tightly-packed rows, without the aforementioned distance between their crowns, will be smothered and not produce fruit, or if they do, it will be small and malformed, which is the reason that often palms that are very close together are thinned out, so that they may bear fruit, which will certainly happen if, e.g., the middle of three palms is cut down. I have seem palm groves that required cutting back not only once, but three or four times, because the soil was rich and verdant, to such a degree that as the palms grew they came closer together, and needed more distance between them.

5. Method For Filling in Palm Groves

CHAPTER V: On the method for filling in palm groves

26. There are two methods for filling in palm groves: one is called shallow filling, and the other adjacent filling, and both are done in different ways. Adjacent filling is only done at the foot of palm trees from time to time, e.g., every three or four years; as palm trees draw sustenance from the ground to nourish themselves, after those three or four years have passed the soil is so weak that it cannot supply the palms any sustenance, and therefore it is necessary to pile more soil at the foot of the palms, from which they can gather new strength to bear fruit.

27. This new soil can either be of the same kind as that

found in the palm grove, or a different kind; if the palm grove soil is sandy, it can be filled in with moist sand, but if it is convenient, it is better to fill it in with red soil from the hills, because it is stronger and more substantial, and experience has shown that it makes for such a mixture that the palm trees are strong and produce a good deal of coconuts.

The reason for this, in my opinion, is not only that hill-soil is stronger, but also because if it is not mixed beforehand with sand, the roots of the palm tree extend more easily in order to draw sustenance to itself from afar, which does not happen when filling is done with sand, which combines and mixes more with the soil of the palm grove.

28. If, however, the soil of the palm grove consists of red hill-soil, the same soil can be used for filling in the grove. But if it is convenient it would be better to do the filling-in with moist sand, because experience has shown the great utility of similar fillings undertaken in groves planted in red soil, because just as red soil does not allow sand to clump and combine with sand, sand does not allow red soil to clump and combine with red soil, which squeezes the palm trees' roots and impedes other plants from taking nourishment from their roots, which spread to nearby places when there are no impediments.

29. The way this shallow filling should be done is not observed by the greater part of palm-growers due to their

lack of awareness, because they content themselves with throwing at the foot of each palm tree twenty, thirty, forty, and at times more baskets of soil, imagining that they have done a fine job of filling in that will result in great profit from following harvests. But in reality they fool themselves, because instead of doing what is right, they do what is wrong, and the expenditures for similar fillings are fruitless and unprofitable; and due to this they are obliged to make more and greater expenditures, which I have clearly demonstrated.

30. Adjacent filling, done in this way, in the first place makes palm trees grow roots above the ground, and those below lose their vitality; and without their old roots, the palms will not only lack fruit, but will be exposed to being blown over by the wind. And it is clear that both things lead to ruin and loss. Secondly, when rain begins to fall, it carries away with it the soil used for adjacent filling at the foot of the palm trees, and with this soil gone, there is no way to profit from the palms. Thirdly, since the rain does not wash away all the soil from the fillings, when the palms are tilled, the plows end up breaking up and dispersing the soil, and in this way the groves end up with the soil, and the palm trees themselves are left without fill. Thenceforth, even if they are filled in in this manner every year, nothing will be gained from this expense.

31. Fourthly, if soil remains heaped at the foot of the palm

trees, water cannot reach the foot of said trees, because water, as a heavy body, seeks out the lowest point, and if water is to reach the palms' roots it is necessary to remove the soil with a hoe, which does away with the initial purpose, or it will be necessary to create another shallow fill-in to even out the ground, which requires another large expenditure that could have been avoided if if the adjacent fill-in was done properly, to avoid all of these expenses and damages. The said fill-in should be done in the following way.

32. After December, in any of the following months up to the 15th or 20th of May, if it has still not rained (since if the soil is wet, filling-in should not be done), dig the *alengas* wide and deep, wide enough so that the fill reaches the roots, which are spread out from the foot of the palms, and as deep as possible without damaging those same roots, so that they may hold enough soil. At the bottom of each *alenga* spread a basket of good ash, the best of which is made from straw taken from brackish rice fields because it is less hot and more succulent; and if ash is not so abundant, spread at least half a basket's worth, and on top of that add enough soil to fill the whole *alenga,* in such a manner that only three or four fingers' worth remain above the level of the palm grove. The rain will settle and pack this down, and the fill will be level with the ground, and in this way the palm trees will not grow roots above ground, nor will rain wash away the soil at the foot of the

palms; tilling the soil will not move it elsewhere, the ground will not be uneven, and the palm trees will enjoy the benefits of being filled in, and ultimately it will not be necessary to fill in every three years, because fill-ins done this way are of the best kind, and will maintain for a longer time the substance of the earth to nourish the palm trees.

33. Having spoken of what pertains to adjacent filling, I will now speak of shallow filling. This is done for one of two reasons, or for both together. The first reason can be to level the ground, which may be high in some places, and low in others; if this is the reason, then of course soil should only be placed in the lowest areas, so that the ground may be completely even.

34. The second reason can be to cover palm tree roots that are exposed and, thereby lacking the sustenance provided by the soil, are weak and produce poor or no fruit. If this is the reason for shallow filling, it should be seen to that the soil is piled high enough to cover the roots and give sustenance to the palm trees, because little or nothing will be gained by spreading only a little soil, as if one were casting seed upon the ground, as many do; the palm grove will have more soil, but the trees themselves will not, and the palm-grower will have more expenses than he expected, but should have seen coming, because palm groves should not be filled in out of habit or ceremony, but out of necessity or convenience.

6. Adding Ash To Palm Groves

CHAPTER VI: On when to add ash to palm groves, and which sort of ash should be used

35. It is a common custom of palm-growers to add ash to their palm groves every year, because they say that the ash greatly refreshes the groves; in this they are egregiously mistaken, because if ash is by its nature hot, how can it refresh the palms' roots to make them bear better fruit? The primary effect of adding ash at the appropriate time is to convey to the palm trees its saline virtue, with which, experience has shown, the palms retain their coconuts, rather than letting them fall, to the great loss of the

palm-grower. To achieve this effect, palm groves are typically spread with ash twice a year, first in the summer, and the second in the winter, at the time of the *mogó* star; however, long experience has shown me that while palm trees benefit greatly from ash spread in the winter, the ash spread in the summer does not benefit them, being added out of season, e.g., from December onward; and I have repeatedly found, after much time has passed, the ash as harsh and dry as it was when it was added.

36. Therefore, those who wish to add ash twice a year to their palm groves should first spread it soon after the last winter rain, when the soil is still moist; for since ash is spongy, like a sponge it absorbs that moisture itself, and keeps it at the foot of the palm tree, and only in this way does ash refresh the trees. The second addition of ash should be done at the beginning of winter, so that the rains disperse the ash as quickly as possible and the palms soon take advantage, via their roots, of its salinity. As it is necessary to dig around the palms to add ash, in those same pits water will remain a while longer, and the palms will draw more sap to use, and bear a more copious amount of fruit.

37. I warn, however, that at both times it is better to use ash made from straw taken from brackish rice fields, rather than ash taken from household stoves, which is hotter; however, in the winter stove ashes may be spread

in palm groves, even in great quantity, because the rain will lessen and destroy its excessive warmth.

38. If one is comfortable in doing so, in the summer it is best to spread powdered brackish slurry at the foot of one's palm trees, because the slurry, which contains the salt that ash does, provides the sustenance that ash does not, and lasts longer; and experience has shown that more benefit is gained from a basket of powdered brackish slurry spread at the foot of a palm tree, than from many baskets of ash. In this way, being more useful, expenses are lower, because if the slurry is available nearby, five baskets of fresh slurry, or a dozen and a half of dried slurry (as I have purchased many times), can be had for the price of one basket of ash. And as it is necessary to spread ash at the foot of the palm trees every year, those who use slurry can add it every three years if they spread four or five baskets of partially dried slurry, or three of fully dried and powdered slurry.

39. Where there is neither ash nor slurry, one of two things can be done. Either a measure and a half of salt, which is advantageous due to its saline nature, can be added to the foot of each palm tree, supplying the salt usually had from slurry and ash; but the salt, which is hot, must be added during the rainy season so that it soon dissolves. Or, foliage from the forest can be added, in the manner I will now describe.

40. When it starts to rain in the winter, open the *alengas*

around the palm trees and fill them with *combió*[11], dinem, ecchi, and various other leaves found in the forest; and after the *alengas* are full, cover them with sufficient soil so that the rain causes the leaves to rot in such a way that they are reduced to ash. Experience has shown that this ash is more suitable for palm trees than any other, and this method can be used in place of [regular] ash and the slurry from areas where palms are located next to estuaries. In this way two tasks are accomplished at once, as the *alengas* are opened to receive water, and ash is added to the palms.

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[11] *Combió* (from Konkani *kombbio*) is the *careya arborea*, also known as wild guava or Ceylon oak, or, as Dalgado notes, *pereira brava* in Portuguese. I have not been able to identify the other two trees mentioned.

7. Thickets Within Palm Groves

CHAPTER VII: Whether or not it is advisable to have thickets within palm groves, and what kind they should be

41. There is no doubt that the more room palm trees have, and the further away they are from anything that may impede the wind, the better off they will be. Routinely speaking, long experience has shown that the lack of wind in palm groves is injurious to them. Palm groves that are densely packed with trees either bear little fruit or none at all, which is why it is necessary to thin out the palms, as I have already said. However, it cannot be denied that there

are many palm groves in which, out of necessity, thickets are planted among the palms, so that they cast some shade but not too much, which would completely impede the trees from getting any wind. These are the groves of *manddoly* and other very warm, dry soils, upon which the heat of the sun makes a greater impression, because these need shade from other trees to defend themselves from the damage the heat will inflict upon them if they do not have it.

42. The main trees useful not only for the aforementioned effect, but also to increase income by means of their fruit, are mango and jackfruit trees. The mango trees should be transplanted, so as not to grow too tall, which will allow for better, sweeter fruit. This transplanting should be done with good varieties of mango, not only at the time of the *mogó* star, as some erroneously claim, but at the start of winter, because in this way they will be old enough in time for the graft to take; and it should be done during the full moon, because at that time the trees' sap is spread out through their trunks, and grafts take more fully. The closer these transplants are done to the peak of the full moon, the more likely they will succeed.

43. If, however, this transplant cannot be done during the full moon for some reason, it should be done at least between the quarter-crescent and the full moon, when the sap of the trees is spread through their branches or trunks;

for transplanting after the full moon, when the sap has gathered in the roots and is not available to the transplants, runs the great risk of the graft not taking. To achieve this effect, an expert grafter should be sought out to carefully cut the grafts, which will be inserted between the bark of the tree and the trunk itself; to split them carefully, cover all the cracks and openings with *cariá* soil[12] so that water does not enter, and finally cover the crowns of the transplanted trees, so that water does not fall on them and somehow get under the bark and doom the transplant.

44. Jackfruit trees should be of a good strain, and of these, some say the *barica* is better than the geriçal[13]. Others are of the opposite opinion, but what is certain is that there are *barica* jackfruit that surpass geriçais, and *geriçais* that surpass *baricas.* However, whether one plants *baricas* or *geriçais* in the palm grove, what is certain is that they often degenerate, because of geriçais baricas remain, and of *baricas*, geriçais.

45. In the common mode of sowing, or of planting varieties of trees, there are many methods and also many errors. Some dig holes sufficiently deep and wide, which

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[12] The *Annaes do Conselho Ultramarino* version of the text is clearer on this point, as the 1918 edition confusingly reads "soil and *cariá*". In this case, "*cariásoil*" appears to be the soil that termites use to build their nests.

[13] *Barica* and *geriçal* are two varieties of jackfruit.

they fill with powdered dried dung and dried palm fronds of the kind used for houses, mixing them with good soil, and within the holes sow kernels almost at surface level. When they break through the soft soil, they soon begin to send out deep roots, growing strongly and, in a few years, they become trees bearing fruit, primarily if in the first three years they are properly watered.

46. Others bury in the ground a whole jackfruit that still has its stem, to which is tied a cord; the other end of the cord is tied to a bamboo stuck in the ground. The bamboo is bent into a bow and held there until the jackfruit rots, whereupon the force of the bamboo unbending launches the core of the jackfruit skyward, leaving only the fleshy parts inside the husk. In time they all sprout together, and once they are slightly grown, they bind together strongly in the earth, and by virtue of this tightness they are united over time, in such a way as to form only one trunk, which within a few years bears fruit in abundance. I have not seen this method of raising jackfruit trees, but I have heard said that it is practiced in some places, and people have told me that they have seen it. However, the trunks of jackfruit trees grown in this manner are in no way suitable for wood, like those raised by the first method, and others I will soon discuss.

47. Others are accustomed to sowing jackfruit seeds in April or May in whatever patch of ground, where they all

sprout and grow until the *mogó* star, when they are uprooted one by one and transplanted somewhere suitable. This is the common method used by the locals for these plantings, but, speaking plainly, they have little success, because jackfruit trees are sensitive and do not consent to having their roots handled, upon pain of all of them dying, or very rarely surviving and ending up very weak, as I experienced many times when I imitated the locals. However, after another method occurred to me, they all turned out successfully, and in a few years they became proper trees. The method I now use is as follows.

48. As far as I am aware, good jackfruits can be had by any means, even if each one costs me double the price. I have little baskets made from bamboo two and a half palmos in height, and three or four in circumference; they are filled with good soil, and in each one I place three kernels, or jackfruit seeds, and have them watered daily at the beginning, and later every other day, until the start of winter, whereupon I completely bury each of the baskets in a suitable place and put a fence around them to defend them from cattle. The baskets soon rot due to the rain, and the young jackfruit trees extend their roots without any trouble or injury.

49. And since I regularly sow these kernels, or seeds, in January or February, from then until June they grow in their little baskets, reaching a height of a mão and a half or

two *mãos* (each *mão* equals two palmos); and planted in the ground within a year, they grow taller than a man of good stature, especially if they are properly watered and care is taken to cut the small branches that grow from the trunk, leaving only the trunk itself. The reason I put three kernels in each basket is that often all of them do not sprout, and if they do sprout, some are weak; however, once all the jackfruit trees have taken root, and only one of them is strong, I cut or uproot the others so that it may fare better. In this way I have raised a great number of jackfruit trees, and others have done the same by imitating my methods.

50. If I were now asked which of these two species of trees is more useful, or less harmful, to plant within palm groves, my reply would be that both are useful for their fruit and yield, but the jackfruit is more useful for its wood, which is excellent and the best in India, after teak. And as the shade of the mango tree is harmful to young palm trees and should be avoided, palms do well with the shade and proximity of jackfruit trees without having to be kept away from them, as can be seen by all who observe these various effects.

51. However, these trees should be planted alongside palm groves, and if it is necessary to plant them within the groves, do so in low ground, or at angles that do not interfere with working the soil. Do not allow other trees,

especially teak or tamarind, within palm groves, because their shade is very harmful. While tamarind trees are profitable due to their fruit, and teak trees due to their wood, the damage they cause impedes more profits than they yield, which take forty or fifty years to obtain. These kinds of trees are suited to the hills, where they can be planted.

8. The Benefits and Gains of Palm Groves

CHAPTER VIII: On other things concerning the benefits and gains of palm groves

52. Many other things are specifically needed for palm groves to be well-tended and fruitful. One is that they are always clear of wild bushes, because these, in addition to sapping the earth of strength, get in the way of working the soil, as is quite obvious. Secondly, every year, from the middle of July, depressions in the beds [in which the trees are planted] should be dug out anew, so that they hold the water necessary for the good of the palm groves.

53. I say from the middle of July onward because, if they

are renovated earlier, and the palm groves are located in sandy soil, the great force of the rains will soon break them apart, and the expense in digging them out will be wasted. And if the palm grove is planted in hill-soil, because this soil is absorbent, the beds will remain full of water, and being dammed up in this way is harmful to the palm groves for two reasons: it rots the roots, without which the trees will not bear fruit, and because if the ground is softened with too much water, strong winds and the weight of bunches of coconuts and fronds will topple the trees, to the great loss of the palm-grower. Renewing the aforementioned depressions from the middle of July onward, when there is not so much rain and the wind is not so strong, does not have the aforementioned dangers, and the palm trees will remain refreshed by the water necessary for their conservation.

54. The third thing that palm groves very much need is repeated tilling of the soil, the more the better. But it must be done in such a way that the soil is well turned, so that the palm trees can freely extend their roots, and the water fully penetrate the earth; Anything else is clawing at the soil, not tilling it. This tilling, in sandy soil, can be started at any time, but it is customary to begin during the rainy season of the *mogó* star, which regularly begins on the 10th or 11th of August, and in this way continuing on with the six customary tillings, until October, with 15 days between each.

55. This should be understood about palm groves in sandy soil: their soil can be tilled in all seasons, but in hill-soil groves tilling should begin sooner, due to the danger of a lack of rain, without which similar soil cannot be worked. After every two tillings a plank (leveller) should be applied, which not only serves to get rid of any stubble but to smooth out the ground, something that is very important in palm groves, and to which many pay little or no attention.

56. When winter is over, two more things are customarily done in the palm groves. The first is having the *alengas* filled in, which consists of filling in those that have been dug for rain, ash, or slurry. However, this work, typically speaking, is done to little or no advantage, because only a little nearby soil is tossed into the *alengas*. I, however, have soil taken from the middle of the beds, which is less exhausted, and used to fill the *alengas* in such a way that this new soil is piled four or six fingers higher than the level of the palm grove. In this way, each year the palm trees remain as if they had been filled in with soil, and are capable of resisting the heat of the sun.

57. The second thing is to dig out the depressions in the beds again, but it is an entirely unnecessary expense for two reasons. The first is because the depressions are only dug and re-dug to conserve water in the beds, and seeing as how there is no water to conserve in that season, it is

easy to see that the effort is unnecessary and without benefit. The second reason is because the depressions do not last until the following winter, but in the summer are broken up by the cattle and people that pass through the palm groves; it is better to scrape away all the stubble there may be in the depressions so that cattle do not come to eat it, and on such occasions totally destroy the depressions, along with whatever small palm, mango, and jackfruit trees and transplants may be found in the palm groves.

9. How to Plant and Maintain Disease-Affected Trees

CHAPTER IX: Teaching how to plant and maintain not only small palm trees but large ones in soil affected by *mondolim*

58. The disease of mondolim is very harmful to palm groves, as it not only keeps young palms planted in infected soil from thriving, but kills large palms as well. For this reason the majority of palm groves planted in sandy soil in the province of Salcete are completely ruined

and deserted, and their landlords do not dare plant anew in that ground, because here nobody has found an efficient treatment for such a great and pernicious evil. I, however, who am accustomed to taking note of all that I see on plantations, often observed that in some palm groves under my care there were in many places two adjacent palms, both of which were very lush because the soil was affected by mondolim. I asked the mocadões (who were already old) how and why those two palms were near one another, when being even further apart was harmful to the palms. They replied that the reason was that because some palms were nearly dead and without hope of survival, they planted others next to them; not only did the new palms thrive, but the original ones revived and were so beautiful, as I had seen, that the new and old palms could not be distinguished from one another.

59. In light of this response I entered into a discussion, and almost guessing the cause of this secret, I ordered that five *mucadões*, who were my subordinates, each plant in their district five palms, next to five others located in soil affected by mondolim and nearly dead. This being done, over time I found that not only all 25 palms planted with the moribund palms survived, but these moribund trees were revitalized, and became so lovely that I could tell the two groups apart only by the signs I had made to tell the second group of trees apart; and I was reassured in my thinking on the matter.

60. And if someone asked me now what the cause of this was? I would respond that only God knows the honest and genuine answer; but what I can conjecture is one of two things. The first being since mondolim is a severe disease, and the small re-planted palms were young, the disease attacked and killed only the first batch; however, after planting the second group of palms, the illness was divided between both groups: and then one palm or another could not only tolerate but prevail against it.

61. The second cause is that, as other things have their sympathies and antipathies, they also exist in those small plants, and so that the first group might remain the lady of the house (so to speak), which the second group also wishes to be, it strives to not be defeated by the replacement group, which for the same reason does not wish to give way to the first group. Be that as it may, however, what is certain is that this is what happened to me and is what I experienced, from which can be inferred the cure, whatever it may be, to keep small palm trees planted in this kind of soil from dying. The only thing I have yet to observe is if the same thing would happen if two palms were planted together in the same hole at the same time, but in my thoughtlessness I failed to do this, and now palm-growers can experiment; and if the same thing happens, they have the remedy in hand.

62. I am well aware that it could be said to me that with

two palm trees in one hole, one would take the wind and sustenance from the other, but there is nothing to fear, for I have seen in various places three truly distinct palm trees grow from one coconut. They grew apart from one another and all bore fruit, without any of the feared dangers. And why would it not be thus for two palms sprouted from two different coconuts buried in the same hole?

63. Something else I have observed in this regard, which I noticed when passing through palm groves infected with this disease, is that the top layer of the soil was very fine, like flour, and seemed rotten; upon having the ground dug up, I found that the soil was very different, because it was more densely packed and of a different color; I decided that the main force of this disease lay on the surface, and this is why palm trees, customarily planted very deeply, die of the disease.

64. For this reason, in two palm groves or plots of land upon which palms had grown, I had soil dug up to the depths of one or one and a half *mãos*, and taken out in baskets; shallow ditches were dug around the said plots, which were completely open and exposed to cattle, and on the level ground I had beds set up and young palms planted in them. In one such plot there were 1,600, give or take a few, and in the other almost 700, all of which, to universal admiration, turned out well and remained healthy while I ran those plantations, though some later

died from little or no care upon the entry of the Maratha enemy. Those who wish to follow this lesson carefully will experience the same thing that others have experienced who planted palms in this or a slightly different manner, which I have seen, and which remained healthy when properly cared for.

65. All that remains now is to teach the means by which to keep large palms planted in this kind of soil from dying, which I will also point out based on observations I have made. In the palm groves I have managed, and the others I have visited, I noticed tall palms resting against banyan trees, which served as forks or stakes preventing the palms from falling over. Stiffened by the roots of the banyan trees, these palms were old and bore much fruit, as is typical of palms planted in such plots, a sign that they are very strong; and discussing the causes of this, I find that palms that are not interlaced among the roots of these trees die, and live insofar as they embrace them, due to one of two principles: either the banyan tree draws the palm tree's disease to itself, or communicates to them some quality that kills off the disease. Even now I am of this opinion and will remain so as long as I have no evidence to the contrary.

66. As soon as the palms in these plots have grown to a suitable height, they should be staked to banyan trees. Since these grow quickly, and entwine their (aerial) roots

with the palm trees, it may be that in this way they survive and thrive, as experience will show. I am well aware that it will be said that if this is done, the palm groves cannot be tilled; but it hardly matters that they are not tilled as long as they remain healthy and bear good fruit, which is what palm-growers expect. Instead of tilling, dig out the soil at the foot of the trees, and perhaps they will yield more, and certainly with less expense.

This is what I understand of these matters, and now I have put it to paper, as many locals asked me to do years ago; but I never had the time to make this resource available to the public, as many have wanted. Now, however, since for good reasons I am asked to satisfy this demand, I satisfy it out of obedience and charity; God willing, these rules will be used advantageously. Those who use them without diverging from any of the points I have mentioned will certainly benefit, because I am not guided in these matters by custom, as the locals are, but by the dictates of reason, founded on observation and experience. God, who is the author of all that is good, wills it that all things succeed prosperously, for His greater glory and the universal good of all.

ARTE PALMÁRICA

is a brief treatise on the cultivation of coconut palms, written by an anonymous Jesuit in Goa. The coconut has been a staple, and symbol, of Goa for centuries, and in this text the nameless author lays out a number of methods for producing the largest, healthiest yields possible. These methods, as he constantly reminds us, are based not on tradition, but on observation and experimentation, and hence superior to those employed by local growers. The author's disdain for these less scientific methods and those who use them is palpable throughout the text.

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